

AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions and listings of claims in the application:

Claim 1 (currently amended): A support structure for supporting a catalyst structure in a catalytic reactor, said support structure having a center and a perimeter and comprising:

a plurality of struts configured to minimally obstruct flow of a gas reaction mixture,

wherein said plurality of struts is configured in at least two branched segments radially arranged about the center of the support structure,

wherein each branched segment comprises a primary strut with proximal and distal ends, wherein the proximal end of the primary strut is proximal to the center and the distal end extends toward the perimeter,

wherein each branched segment further comprises a secondary strut with proximal and distal ends, wherein the proximal end of the secondary strut contacts the primary strut at a position between the proximal and distal ends of the primary strut, and wherein the distal end of the secondary strut extends toward the perimeter,

and wherein each branched segment further comprises additional secondary struts with proximal and distal ends, wherein the additional secondary struts alternate in branched fashion in a direction from the center toward the perimeter, wherein the proximal end of each additional secondary strut contacts the previous secondary strut toward the center in the branched segment at a position between the proximal and distal ends of the previous secondary strut and the distal end of each additional secondary strut extends toward the perimeter,

~~wherein the contact between the struts and the catalyst structure does not cause significant deformation of the catalyst structure at high axial loads,~~

wherein the struts are configured such that the struts are free to thermally expand and contract as the temperature changes,

and wherein the struts are configured to provide substantially uniform support with respect to a substantial portion of the catalyst structure.

Claim 2 (previously presented): The support structure of claim 1 wherein the distance between alternate consecutive secondary struts in a branched segment is substantially constant.

Claim 3 (previously presented): The support structure of claim 1 wherein at least one strut of one branched segment is parallel to at least one strut of another branched segment.

Claim 4 (original): The support structure of claim 1 wherein the outer perimeter substantially defines a circle.

Claim 5 (previously presented): The support structure of claim 1 wherein alternate secondary struts are substantially parallel to each other.

Claim 6 (previously presented): The support structure of claim 1 wherein at least one strut includes at least one bend.

Claim 7 (previously presented): The support structure of claim 1 wherein at least one strut is straight.

Claim 8 (previously presented): The support structure of claim 1 wherein at least one secondary strut includes at least one bend.

Claim 9 (previously presented): The support structure of claim 1 wherein each consecutive strut is connected to the previous strut at a variable distance from the proximal end of the previous strut.

Claim 10 (currently amended): The support structure of claim 1 wherein each consecutive strut is connected to the previous strut at a constant ~~distance~~ distance from the proximal end of the previous strut.

Claims 11-12 (canceled)

Claim 13 (previously presented): The support structure of claim 1 wherein at least one strut includes a bend such that its distal end is substantially perpendicular to the perimeter.

Claims 14-15 (canceled)

Claim 16 (original): The support structure of claim 1 wherein the center is located substantially at the center of the perimeter.

Claim 17 (previously presented): The support structure of claim 1 wherein the support structure comprises a hub located at the center of the support structure.

Claim 18 (previously presented): The support structure of claim 17, further comprising a center spindle attached to the hub.

Claim 19 (previously presented): The support structure of claim 18, further comprising a second support structure attached to the center spindle.

Claim 20 (original): The support structure of claim 1 wherein at least one strut is corrugated.

Claim 21 (original): The support structure of claim 20 wherein the at least one corrugated strut is connected to the center.

Claim 22 (canceled)

Claim 23 (original): The support structure of claim 20 wherein the consecutive struts connected to the corrugated strut are connected with lap joints.

Claim 24 (canceled)

Claim 25 (previously presented): The support structure of claim 1 wherein the primary struts are connected to the center with slip joints.

Claim 26 (previously presented): The support structure of claim 25 wherein the proximal end each primary strut connected to the center includes at least one tongue, and wherein the center includes at least one slot adapted to receive the at least one tongue.

Claim 27 (previously presented): The support structure of claim 1 wherein at least one secondary strut is connected to the previous strut with a slip joint.

Claim 28 (previously presented): The support structure of claim 27 wherein said previous strut includes at least one slot and the proximal end of said at least one secondary strut includes at least one tongue, wherein a tongue of the at least one secondary strut is received in a slot of the previous strut.

Claim 29 (original): The support structure of claim 1 further including an outer ring encompassing the branched segments.

Claim 30 (previously presented): The support structure of claim 29 wherein the outer ring includes a plurality of peaks and troughs radially arranged about the outer ring, wherein the distal ends of at least some of the struts are coupled to the outer ring at the troughs.

Claim 31 (previously presented): The support structure of claim 29, wherein the distal ends of at least some of the struts are coupled to the outer ring.

Claim 32 (previously presented): The support structure of claim 31, wherein at least some of the struts are coupled to the outer ring with a slip joint.

Claim 33 (previously presented): The support structure of claim 1 wherein the distal end of at least one strut includes a flange.

Claim 34 (previously presented): The support structure of claim 33 further including an outer ring having an expansion slot, wherein the flange is received within the expansion slot such that the at least one strut is retained yet substantially free to move in a radial direction within the expansion slot.

Claim 35 (original): The support structure of claim 1 wherein the distal end of at least one strut includes at least two notches to form a T-end.

Claim 36 (previously presented): The support structure of claim 35 further including an outer ring having an expansion slot, wherein the T-end is received within the expansion slot such that the strut is retained yet substantially free to move in a radial direction within the expansion slot.

Claim 37 (original): The support structure of claim 1 wherein the distal end of at least one strut includes a slot.

Claim 38 (original): The support structure of claim 37 further including an outer ring passed through the slot such that the distal end is retained yet substantially free to move in a radial direction.

Claim 39 (previously presented): The support structure of claim 1 wherein at least one strut is connected to the center with at least a braze lug.

Claim 40 (previously presented): The support structure of claim 1 wherein at least one secondary strut is connected to the previous strut with at least a braze lug.

Claim 41 (previously presented): The support structure of claim 39 or 40 wherein the braze lug includes at least two flanges, a strut receiving portion coupled to the at least two flanges, at least two tabs coupled to the at least two flanges, and at least one tab coupled to the strut receiving portion.

Claim 42 (previously presented): The support structure of claim 1 wherein at least a portion of the distal ends of said plurality of struts are connected to an outer ring.

Claim 43 (previously presented): The support structure of claim 42 wherein the at least a portion of the distal ends are connected to the outer ring with a slip joint.

Claim 44 (previously presented): The support structure of claim 1 wherein at least a portion of each of the distal ends of said plurality of struts includes a flange.

Claim 45 (previously presented): The support structure of claim 44, further comprising an outer ring comprising expansion slots, wherein the flanges are received within the expansion slots such that they are retained yet substantially free to move in a radial direction within the expansion slots.

Claim 46 (previously presented): The support structure of claim 1 wherein at least a portion of each of the distal ends of said plurality of struts includes at least two notches to form a T-end.

Claim 47 (previously presented): The support structure of claim 46, further comprising an outer ring comprising expansion slots, wherein the T-ends are received within the expansion slots such that they are retained yet substantially free to move in a radial direction within the expansion slots.

Claim 48 (withdrawn): A support structure according to claim 145 comprising:

a center;

at least three branched segments oriented about the center and encompassed by a perimeter; each branched segment comprising:

a primary strut having a proximal end and a distal end; the primary strut having an intersection with the center at the proximal end and extending to the perimeter at the distal end;

a plurality of secondary struts; each secondary strut having a proximal end and at least one distal end; each secondary strut having an intersection with the primary strut at the proximal end of the secondary strut and extending to the perimeter at the distal end of the secondary strut.

Claim 49 (withdrawn): The support structure of claim 48 wherein the outer perimeter substantially defines a circle.

Claim 50 (withdrawn): The support structure of claim 48 wherein the center is located substantially at the center of the perimeter.

Claim 51 (withdrawn): The support structure of claim 48 wherein the primary strut is substantially radial.

Claim 52 (withdrawn): The support structure of claim 48 wherein the primary strut includes at least one bend.

Claim 53 (withdrawn): The support structure of claim 48 wherein at least one secondary strut is straight.

Claim 54 (withdrawn): The support structure of claim 48 wherein at least one secondary strut includes at least one bend.

Claim 55 (withdrawn): The support structure of claim 48 wherein intersections of the secondary struts with the primary strut along the primary strut are substantially equally spaced.

Claim 56 (withdrawn): The support structure of claim 48 wherein at least one secondary strut includes an elbow.

Claim 57 (withdrawn): The support structure of claim 48 wherein the at least one secondary strut includes an elbow such that its distal end is substantially perpendicular to the perimeter.

Claim 58 (withdrawn): The support structure of claim 48 wherein the primary strut includes an elbow.

Claim 59 (withdrawn): The support structure of claim 48 wherein secondary struts define a distance between secondary struts that is substantially constant.

Claim 60 (withdrawn): The support structure of claim 48 wherein adjacent secondary struts are substantially equally spaced.

Claim 61 (withdrawn): The support structure of claim 48 wherein the primary strut includes a first side and a second side; and

wherein secondary struts extending from the first side of the primary strut are substantially parallel to each other and secondary struts extending from the second side of the primary strut are substantially parallel to each other.

Claim 62 (withdrawn): The support structure of claim 61 wherein the primary strut is substantially parallel to at least one secondary strut of another branched segment.

Claim 63 (withdrawn): The support structure of claim 48 wherein the center is a hub.

Claim 64 (withdrawn): The support structure of claim 63 wherein the hub is adapted to receive a spindle for transferring a load.

Claim 65 (withdrawn): The support structure of claim 63 wherein a load is transferred to a second support structure located upstream.

Claim 66 (withdrawn): The support structure of claim 48 wherein the primary strut is corrugated.

Claim 67 (withdrawn): The support structure of claim 66 wherein the intersection of each secondary strut with the primary strut is a lap joint.

Claim 68 (withdrawn): The support structure of claim 48 wherein at least one secondary strut is corrugated.

Claim 69 (withdrawn): The support structure of claim 68 wherein secondary struts connected to the corrugated secondary strut are connected with lap joints.

Claim 70 (withdrawn): The support structure of claim 48 wherein the intersection of the primary strut with the center is a slip joint.

Claim 71 (withdrawn): The support structure of claim 70 wherein the proximal end of the primary strut includes at least one tongue; the center includes at least one slot adapted to receive the at least one tongue.

Claim 72 (withdrawn): The support structure of claim 48 wherein the intersection of each secondary strut with the primary strut is a slip joint.

Claim 73 (withdrawn): The support structure of claim 72 wherein the primary strut includes at least one slot and the proximal end of the secondary strut includes at least one tongue, the tongue of the secondary strut being received in the slot of the primary strut.

Claim 74 (withdrawn): The support structure of claim 72 wherein the primary strut includes at least one slot and the secondary strut is bent and includes at least two distal ends; the secondary strut being received in the slot of primary strut.

Claim 75 (withdrawn): The support structure of claim 48 further including at least one primary strut that is located between branched segments.

Claim 76 (withdrawn): The support structure of claim 75 wherein the at least one primary strut located between branched segments is substantially parallel to at least one secondary strut.

Claim 77 (withdrawn): The support structure of claim 75 wherein the at least one primary strut located between branched segments is equally spaced from at least one secondary strut.

Claim 78 (withdrawn): The support structure of claim 75 wherein at least one secondary strut and at least one primary strut that is located between branched segments define a distance between at least one secondary strut and at least one primary strut that is located between branched segments that is substantially constant.

Claim 79 (withdrawn): The support structure of claim 48 further including an outer ring encompassing the branched segments.

Claim 80 (withdrawn): The support structure of claim 79 wherein the outer ring includes a plurality of peaks and troughs.

Claim 81 (withdrawn): The support structure of claim 80 wherein the distal ends of both primary and secondary struts are connected to the outer ring at the troughs formed substantially in a radial direction.

Claim 82 (withdrawn): The support structure of claim 79 wherein at least one primary strut or at least one secondary strut is coupled to the outer ring via a slip joint.

Claim 83 (withdrawn): The support structure of claim 48 wherein the distal end of at least one primary or at least one secondary strut includes a flange.

Claim 84 (withdrawn): The support structure of claim 83 further including an outer ring having an expansion slot, the flange being received within the expansion slot such that the strut is retained yet free to move in a radial direction within the expansion slot.

Claim 85 (withdrawn): The support structure of claim 48 wherein the distal end of either at least one primary or secondary strut includes at least two notches to form a T-end.

Claim 86 (withdrawn): The support structure of claim 85 further including an outer ring having an expansion slot, the T-end being received within the expansion slot such that the strut is retained yet substantially free to move in a radial direction within the expansion slot.

Claim 87 (withdrawn): The support structure of claim 48 wherein the distal end of either at least one primary or secondary strut includes at least one slot.

Claim 88 (withdrawn): The support structure of claim 87 further including an outer ring passed through the slot such that the distal end is retained yet substantially free to move in a radial direction.

Claim 89 (withdrawn): The support structure of claim 48 wherein the intersection of the primary strut with the center includes a braze lug.

Claim 90 (withdrawn): The support structure of claim 89 wherein the braze lug includes at least two flanges, a strut receiving portion coupled to the at least two flanges, at least two tabs coupled to the at least two flanges, and at least one tab couple to the strut receiving portion.

Claim 91 (withdrawn): A support structure according to claim 145 comprising:

a center;

an outer ring encompassing the center;

a plurality of primary struts; each primary strut having a proximal end connected to the center and a distal end connected to the outer ring;

a plurality of cantilevered struts; each cantilevered strut having a distal end connected to the outer ring and a proximal end extending towards the center.

Claim 92 (withdrawn): The support structure of claim 91 wherein at least one cantilevered strut is located between primary struts.

Claim 93 (withdrawn): The support structure of claim 91 wherein the primary struts are substantially radial.

Claim 94 (withdrawn): The support structure of claim 91 wherein the cantilevered struts are substantially radial.

Claim 95 (withdrawn): The support structure of claim 91 wherein the center is a hub.

Claim 96 (withdrawn): The support structure of claim 91 wherein the center is located substantially at the center of the outer ring.

Claim 97 (withdrawn): A support structure according to claim 145 comprising:

a center;

an outer ring encompassing the center;

a plurality of struts configured about the center; each strut of the plurality of struts having a proximal end and a distal end; each distal end being connected to the outer ring; a first portion of struts being connected to the center at their proximal ends;

wherein at least one strut that is connected to the outer ring is movably connected at the outer ring such that the distal end of the at least one strut is substantially free to move relative to the outer ring.

Claim 98 (withdrawn): The support structure of claim 97 wherein each strut is adapted to react a load in an axial direction.

Claim 99 (withdrawn): The support structure of claim 97 further including a second portion of struts; at least one strut of the second portion being connected at its proximal end to another strut such that the proximal end of the at least one strut of the second portion is substantially free to move relative to the another strut.

Claim 100 (withdrawn): The support structure of claim 97 wherein at least one strut of the first portion is connected to the center such that the proximal end of the at least one strut of the first portion is substantially free to move relative to the center.

Claim 101 (withdrawn): The support structure of claim 97 wherein the plurality of struts are configured into branched segments oriented about the center.

Claim 102 (withdrawn): The support structure of claim 97 wherein the center is located substantially at the center of the outer ring.

Claim 103 (withdrawn): The support structure of claim 97 wherein the outer ring includes an expansion slot.

Claim 104 (withdrawn): The support structure of claim 103 wherein the expansion slot is formed by attaching a receiving portion to the outer ring.

Claim 105 (withdrawn): The support structure of claim 104 wherein the outer ring includes an outer surface and a slot, the receiving portion being attached to an outer surface of the outer ring at the slot.

Claim 106 (withdrawn): The support structure of claim 97 wherein the distal end of at least one strut connected to the outer ring includes a flange.

Claim 107 (withdrawn): The support structure of claim 106 wherein the flange is movably retained within an expansion slot.

Claim 108 (withdrawn): The support structure of claim 97 wherein the distal end of at least one strut connected to the outer ring includes at least two notches forming a T-end

Claim 109 (withdrawn): The support structure of claim 108 wherein the T-end is movably retained within the expansion slot.

Claim 110 (withdrawn): The support structure of claim 97 wherein the distal end of at least one strut connected to the outer ring includes at least one slot.

Claim 111 (withdrawn): The support structure of claim 110 wherein the outer ring is passed through the slot such that the distal end is retained yet substantially free to move in a radial direction.

Claim 112 (withdrawn): A support structure according to claim 145 for being disposed within an outer containment comprising:

a center;

a plurality of struts configured about the center; each strut of the plurality of struts having a proximal end and a distal end; each distal end being connected to the outer containment; a first portion of struts being connected to the center at their proximal ends;

wherein at least one strut that is connected to the outer containment is movably connected to the outer containment such that the distal end of the at least one strut is substantially free to move relative to the outer containment.

Claim 113 (withdrawn): The support structure of claim 112 wherein each strut is adapted to react a load in an axial direction.

Claim 114 (withdrawn): The support structure of claim 112 further including a second portion of struts; at least one strut of the second portion being connected at its proximal end to another strut such that the proximal end of the at least one strut of the second portion is substantially free to move relative to the another strut.

Claim 115 (withdrawn): The support structure of claim 112 wherein at least one strut of the first portion is connected to the center such that the proximal end of the at least one strut of the first portion is substantially free to move relative to the center.

Claim 116 (withdrawn): The support structure of claim 112 wherein the plurality of struts are configured into branched segments oriented about the center.

Claim 117 (withdrawn): The support structure of claim 112 wherein the center is located substantially at the center of the support structure.

Claim 118 (withdrawn): The support structure of claim 112 wherein the outer containment includes an expansion slot.

Claim 119 (withdrawn): The support structure of claim 118 wherein the expansion slot is formed by attaching a receiving portion to the outer containment.

Claim 120 (withdrawn): The support structure of claim 119 wherein the outer containment includes an outer surface and a slot, the receiving portion being attached to an outer surface of the outer containment at the slot.

Claim 121 (withdrawn): The support structure of claim 112 wherein the distal end of at least one strut connected to the outer containment includes a flange.

Claim 122 (withdrawn): The support structure of claim 121 wherein the flange is movably retained within an expansion slot.

Claim 123 (withdrawn): The support structure of claim 112 wherein the distal end of at least one strut connected to the outer containment includes at least two notches forming a T-end.

Claim 124 (withdrawn): The support structure of claim 123 wherein the T-end is movably retained within an expansion slot.

Claim 125 (withdrawn): The support structure of claim 112 wherein the distal end of at least one strut connected to the outer containment includes at least one slot.

Claim 126 (withdrawn): The support structure of claim 125 wherein the distal end of at least one strut connected to the outer containment is connected at the slot such that the distal end is retained yet substantially free to move in a radial direction.

Claim 127 (withdrawn): A support structure according to claim 145 for being disposed within an outer containment comprising:

a center;

a plurality of struts configured about the center; each strut of the plurality of struts having a proximal end and a distal end; a first portion of struts being connected to the center at their proximal ends; a second portion of struts wherein each strut of the second portion is connected to another strut at its proximal end;

wherein at least one strut of the first portion is connected such that its proximal end is substantially free to move relative to the center; and at least one strut of the second portion is connected such that its proximal end is free to move relative to the another strut.

Claim 128 (withdrawn): The support structure of claim 127 further including an outer ring; the distal ends are connected to the outer ring.

Claim 129 (withdrawn): The support structure of claim 127 wherein at least one strut is connected at its distal end to the outer ring such that the distal end of the at least one strut is substantially free to move with respect to the outer ring.

Claim 130 (withdrawn): The support structure of claim 127 wherein distal ends are connected to the outer containment.

Claim 131 (withdrawn): The support structure of claim 127 wherein at least one strut is connected at its distal end to the outer containment such that the distal end of the at least one strut is substantially free to move with respect to the outer containment.

Claim 132 (withdrawn): The support structure of claim 127 wherein the plurality of struts are configured into branched segments oriented about the center.

Claim 133 (withdrawn): A support structure for a catalyst comprising:

a center;

a plurality of struts configured into branched segments about the center;

wherein the distance between adjacent struts provides a substantially uniform contact stress with respect to a substantial portion of the catalyst.

Claim 134 (withdrawn): A support structure comprising:

a center;

a plurality of struts; each strut having a proximal end and a distal end; the plurality of struts being configured about the center such that each strut is substantially free to expand or to contract at its distal or proximal end as temperature changes.

Claim 135 (withdrawn): The support structure of claim 134 wherein the plurality of struts is configured into at least two branched segments oriented about the center.

Claim 136 (withdrawn): The support structure of claim 135 further including a perimeter encompassing the plurality of struts;

wherein each branched segment includes:

a primary strut having a proximal end and a distal end; the proximal end of the primary strut having an intersection with the center; the primary strut extending to the perimeter at its distal end;

a plurality of secondary struts; each secondary strut having a proximal end and a distal end; the proximal end of each secondary strut having an intersection with the primary strut and extending to the perimeter at the distal end of each secondary strut.

Claim 137 (withdrawn): A support structure according to claim 145 comprising:

a center;

an outer perimeter encompassing the center;

a plurality of struts forming at least two branched segments oriented about the center; wherein each branched segment includes:

a first strut having a proximal end and a distal end; the proximal end of the first strut being connected to the center and extending to the perimeter at its distal end;

at least a second strut having a proximal end and a distal end; the proximal end of the second strut being connected to the first strut and extending to the perimeter at its distal end.

Claim 138 (withdrawn): The support structure of claim 137, further including

a third strut having a proximal end and a distal end; the proximal end of the third strut being connected to the second strut such that the third strut is substantially parallel to the first strut and spaced a distance from the first strut; the third strut extends to the perimeter at its distal end.

Claim 139 (withdrawn): The support structure of claim 138 further including

a fourth strut having a proximal end and a distal end; the proximal end of the fourth strut being connected to the third strut such that the fourth strut is substantially parallel to the second strut and spaced a distance from the second strut; the fourth strut extends to the perimeter at its distal end.

Claim 140 (withdrawn): The support structure of claim 139 further including

a fifth strut having a proximal end and a distal end; the proximal end of the fifth strut being connected to the fourth strut such that the fifth strut is substantially parallel to the third strut and spaced a distance from the third strut; the fifth strut extends to the perimeter at its distal end.

Claim 141 (withdrawn): The support structure of claim 140 further including

a sixth strut having a proximal end and a distal end; the proximal end of the sixth strut being connected to the fifth strut such that the sixth strut is substantially parallel to the fourth strut and spaced a distance from the fourth strut; the sixth strut extends to the perimeter at its distal end.

Claim 142 (withdrawn): The support structure of claim 141 further including

at least a seventh strut having a proximal end and a distal end; the proximal end of the seventh strut being connected to the sixth strut such that the seventh strut is substantially parallel to the fifth and spaced a distance from the fifth strut; the seventh strut extends to the perimeter at its distal end.

Claim 143 (withdrawn): The support structure of claim 137 wherein the distance is approximately constant.

Claim 144 (withdrawn): The support structure of claim 137 wherein the center is located at substantially the center of the support structure.

Claim 145 (withdrawn): A support structure for supporting a catalyst structure in a catalytic reactor, said support structure having a center and a perimeter and comprising a plurality of struts configured to minimally obstruct flow of a gas reaction mixture,

wherein each strut comprises a proximal end and a distal end, wherein the distal end of each strut extends toward the perimeter,

wherein the contact between the struts and the catalyst structure does not cause significant deformation of the catalyst structure at high axial loads,

wherein the struts are configured such that the struts are free to thermally expand and contract as the temperature changes, and

wherein said plurality of struts is configured to provide substantially uniform support with respect to a substantial portion of the catalyst structure.

Claim 146 (withdrawn): A support structure according to claim 145, comprising primary struts that are radially arranged about the center of the support structure, said primary struts contacting the center, and further comprising secondary struts that do not contact the center,

wherein the struts are configured in at least two branched segments radially arranged about the center of the support structure,

wherein each branched segment comprises alternate secondary struts that are substantially parallel to each other.

Claim 147 (previously presented): A support structure according to claim 18, wherein said center spindle transfers an axial load upstream to a second support structure.